

INTERNATIONAL STANDARD

NORME INTERNATIONALE

**Measuring relays and protection equipment –
Part 22-4: Electrical disturbance tests – Electrical fast transient/burst immunity
test**

**Relais de mesure et dispositifs de protection –
Partie 22-4: Essais d'influence électrique – Essai d'immunité aux transitoires
électriques rapides en salves**

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IEC 60255-22-4:2008

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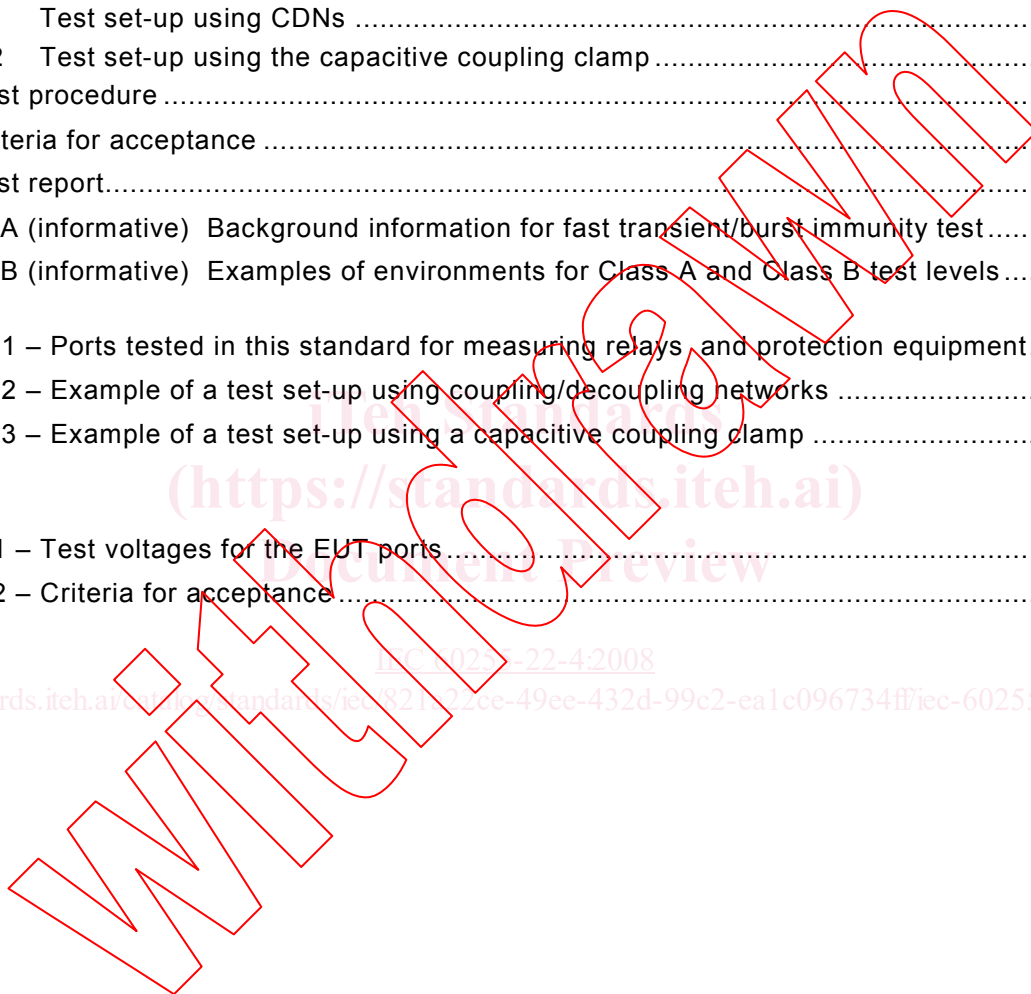
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INTERNATIONAL ELECTROTECHNICAL COMMISSION

MEASURING RELAYS AND PROTECTION EQUIPMENT –**Part 22-4: Electrical disturbance tests –
Electrical fast transient/burst immunity test**

FOREWORD

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International Standard IEC 60255-22-4 has been prepared by IEC technical committee 95: Measuring relays and protection equipment.

This third edition cancels and replaces the second edition published in 2002. It constitutes a technical revision.

The main change with respect to the previous edition is:

- the improvement of the test severity level regarding the repetition rate.

The text of this part is based on the following documents:

FDIS	Report on voting
95/228/FDIS	95/233/RVD

Full information on the voting for the approval of this standard can be found in the voting on report indicated in the above table.

A list of all parts of IEC 60255 series, published under the general title *Measuring relays and protection equipment*, can be found on the IEC website.

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

The committee has decided that the contents of this publication will remain unchanged until the maintenance result date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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MEASURING RELAYS AND PROTECTION EQUIPMENT –

Part 22-4: Electrical disturbance tests – Electrical fast transient/burst immunity test

1 Scope and object

This part of IEC 60255-22 is based on IEC 61000-4-4, referring to that publication where applicable, and specifies the general requirements for electrical fast transient immunity tests for measuring relays and protection equipment for power system protection, including the control, monitoring and process interface equipment used with these systems.

The objective of the tests is to confirm that the equipment under test will operate correctly when energized and subjected to repetitive fast transients (bursts) such as those originating from interrupting of inductive loads, relay contact bounce, etc.

The requirements specified in this standard are applicable to measuring relays and protection equipment in a new condition and all tests specified are type tests only.

The object of this standard is to state:

- definitions of terms used;
- test severity level;
- test equipment;
- test set-up;
- test procedures;
- criteria for acceptance;
- test report requirements.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60050-161, *International Electrotechnical Vocabulary – Chapter 161: Electromagnetic compatibility*

IEC 60255-6:1988, *Electrical relays – Part 6: Measuring relays and protection equipment*

IEC 61000-4-4:2004, *Electromagnetic compatibility (EMC) – Part 4-4: Testing and measurement techniques – Electrical fast transient/burst immunity test*

3 Terms and definitions

For the purposes of this document the following terms and definitions apply.

3.1 EUT

equipment under test, which may be either a measuring relay or a protection equipment

3.2

auxiliary equipment

equipment necessary to provide the EUT with the signals required for normal operation and equipment to verify the performance of the EUT

3.3

burst

sequence of a limited number of distinct pulses or an oscillation of limited duration

[IEV 161-02-07]

3.4

CDN

coupling and decoupling devices which have been integrated into one box

3.5

communication port

interface with a communication and/or control system, using low energy signals, permanently connected to the EUT

3.6

functional earth port

a port on the EUT which is connected to earth for purposes other than electrical safety

3.7

input port

port through which the EUT is energized or controlled in order to perform its function(s), for example current transformer, voltage transformer, binary (status), analogue inputs, etc.

3.8

output port

port through which the EUT produces predetermined changes, for example contacts, optocoupler, analogue outputs, etc.

3.9

port

particular interface of the EUT with the external electromagnetic environment

[IEC 61000-4-4, 4.2]

3.10

auxiliary power supply port

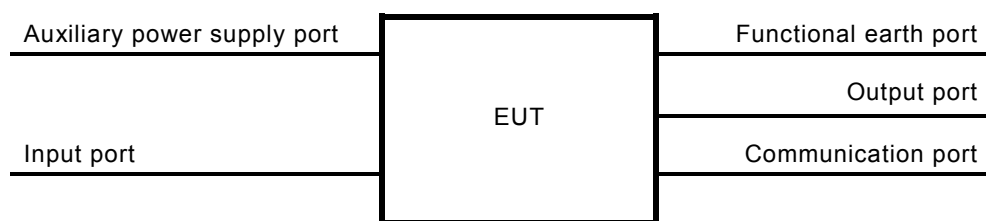
AC or DC auxiliary energizing input of the EUT

3.11

transient

pertaining to or designating a phenomenon or a quantity which varies between two consecutive steady states during a time interval short compared with the time-scale of interest

[IEV 161-02-01]



IEC 914/02

Figure 1 – Ports tested in this standard for measuring relays and protection equipment

4 Test severity level

The test voltages for the appropriate ports of the EUT in Class B and Class A applications are shown in Table 1. The repetition rates of the test waveforms should be as defined in IEC 61000-4-4 as shown in Table 1.

Unless otherwise stated, no test is advised for ports interfacing with cables whose total length according to the manufacturers functional specification is always less than 10 m.

For the functional earth port, the fast transient/burst test is not applicable to this port if interfacing with cables whose total length according to the manufacturers functional specification is always less than 3 m. It is not recommended to apply this test when the functional earth and protective earth are a single connection. When these earths are separate connections, the protective earth should not be disconnected when applying the tests to the functional earth.

The fast transient/burst test is not applicable to the communications port if interfacing with cables which are, in normal use, permanently connected, and whose total length according to the manufacturers functional specification is always less than 3 m.

Table 1 – Test voltages for the EUT ports

Port under test	Open-circuit output test voltage and repetition rates			
	Class B		Class A	
	Peak voltage kV \pm 10 %	Repetition rate kHz \pm 10 %	Peak voltage kV \pm 10 %	Repetition rate kHz \pm 10 %
Functional earth	2	5 or 100	4	5 or 100
Auxiliary power supply inputs	2	5 or 100	4	5 or 100
Input/output ports	2	5 or 100	4	5 or 100
Communication	1	5 or 100	2	5 or 100

NOTE 1 Information regarding the choice between class A and class B test levels are given in Annex B.

NOTE 2 Use of 5 kHz rates is traditional; however, 100 kHz is closer to reality. Repetition rate shall be stated by the manufacturer.

5 Test equipment

The test equipment is described in IEC 61000-4-4, Clause 6. This includes a description of the test generator, CDN and capacitive coupling clamp.

6 Test set-up

The general test set-ups are specified in IEC 61000-4-4, Clause 7.

All auxiliary equipment used to provide the EUT with signals for normal operation, and to verify the correct operation of the EUT, must be decoupled, so that the test voltage does not affect the auxiliary equipment. The common mode rejection of the decoupling device shall be as high as possible in order to minimize the degradation of the common mode rejection ratio of the EUT port.

Normally, the EUT shall be individually tested with the EUT placed on an insulating support 0,1 m above the ground reference plane, and all parts of the EUT shall be at least 0,5 m from any metallic structure. If the EUT is to be tested on a non-conducting table, normally 0,8 m high, the ground reference plane may be placed under the table.

Where the EUT is exclusively mounted in a cubicle, the tests may be conducted with the EUT in the cubicle. No test shall be performed on interconnecting cables between EUT which are completely within the cubicle, these being regarded as internal cables of the system. The cubicle should be placed on an insulating support, 0,1 m above the ground reference plane. Interconnecting cables greater than 1 m in length belonging to the EUT shall remain on the insulating support.

Apart from the port being tested, the connections to all other ports shall be arranged to provide a high impedance path to earth for the fast transient. This may be provided by open circuits (where the circuit is not subject to supply or monitoring) or leads longer than 2 m. Where necessary for the supply or monitoring equipment, decoupling circuits or devices may be added in the leads, connected as shown in Figure 2.

6.1 Test set-up using CDNs

The application of the fast transient test voltage to the EUT using a CDN, as defined in IEC 61000-4-4, 6.2, is the only test method for the auxiliary power supply port, and the preferred method for the AC current and voltage ports. The test voltage shall be applied in common mode to all ports of the EUT in turn.

An example of the test set-up using the CDN is shown in Figure 2.

The length of leads between the fast transient generator and the CDN should be as short as possible; the use of a single assembly for the generator and the CDN is preferred. The leads to the EUT should be no longer than 1 m.

Auxiliary equipment required for the defined operation of the EUT according to the specifications, for example communication equipment, as well as auxiliary equipment necessary for ensuring any data transfer and assessment of the functions, shall be connected to the EUT through CDNs. However, as far as possible the number of cables to be tested should be limited by restricting attention to the representative functions.

6.2 Test set-up using the capacitive coupling clamp

For the application of the fast transient test voltage to circuits where a direct connection to the terminals of the EUT is not possible, or where the insertion of a CDN itself would upset the operation of the EUT, a capacitive coupling clamp, as defined in IEC 61000-4-4, 6.3, shall be used. This test method is the preferred one for the functional earth, status input, output contact and communication ports, and it is recommended that each port is tested in turn, with all cables to each port tested simultaneously where practical.

NOTE An example of such an application is where the fast transient test voltage would be applied to a connection between separate units belonging to the same protection equipment or system

An example of the test set-up using the capacitive coupling clamp is shown in Figure 3.

The port being tested shall be connected using the type of cable and method of termination and connections recommended by the manufacturer. The cable between the capacitive coupling clamp and the equipment under test shall be no longer than 1 m. The cable between the auxiliary equipment and the clamp shall extend at least 10 m (or the maximum length permitted by the manufacturer if less than 10 m) from the clamp. Excess cable should be loosely coiled, maintaining a distance of at least 0,1 m from any ground plane or metallic structure.

7 Test procedure

The tests shall be carried out at the reference conditions given in IEC 60255-6.

Time delay settings of the EUT shall be set to their minimum practical values as defined by their intended application.

The tests shall be carried out with auxiliary energizing quantities applied to the appropriate circuits, using auxiliary energizing quantities equal to rated values. The values of the input energizing quantities shall be within twice the assigned error of the transitional state both below and above the operate value.

If the rated conditions of the EUT mean that the input energizing quantity is much lower than the relay operate value, the tests shall be performed at the continuous thermal withstand value.

The test voltage shall be applied in common mode to one port at a time for at least 1 min for each polarity, and the conformance to the acceptance criteria shall be checked.

8 Criteria for acceptance

Table 2 lists the important functions which could apply to a measuring relay or protection equipment. These should be monitored during the test.

The EUT has passed the test if it fulfils the criterion for acceptance according to Table 2 and, after the test has been completed, still complies with the relevant performance specification.

Table 2 – Criteria for acceptance

Function	Criterion for acceptance
Protection	Normal performance within the specification limits
Command and control	Normal performance within the specification limits
Measurement	Temporary degradation during test, with self-recovery at the end of the test. No loss of stored data
Integral human-machine interface and visual alarms	Temporary degradation or loss of function during test, with self-recovery at the end of the test. No loss of stored data
Data communication	Possible bit error rate increase but no loss of transmitted data

9 Test report

The test report shall include:

- the identification and configuration of the EUT;
- the test conditions;